

GIROZ

Software de gestión de mangas

gzround

Ángel Herranz

Julio 2005

Resumen

¿Qué echan de menos los pilotos de coches de radio control? A todos nos encantaría disponer de un cuenta vueltas automático. Los sistemas comerciales basados en transponders como el de AMB o el basado en infrarojos como LapZ suelen tener un precio prohibitivo para la mayor parte de pilotos e incluso para los clubes. Correr con una bandera en la antena tampoco parece muy atractivo, a la vez que poco fiable.

GIROZ es un sistema basado en transponders y luz infrarroja similar a LapZ con un número máximo de 24 emisores posibles que podrían correr simultáneamente. Los modelos pasan bajo un puente de detección por lo que es necesario que nada opaco interrumpa la luz entre el transponder y los receptores instalados en el puente. El consumo de cada transponder es inferior a 10 miliamperios por lo que no se resta “punch” al motor. GIROZ garantiza la detección con una alimentación de 2.4 voltios.

La comunicación con un sistema de cronometraje se realiza a través del puerto paralelo con la ayuda de un módulo software específico para el sistema GIROZ.

Este documento describe varios programas que permiten la gestión de varias series con el sistema GIROZ.

Índice

1. Requisitos mínimos	5
2. Instalación del sistema GiroZ	5
3. El programa gzround	6
3.1. gztest	7
3.2. gzround	7
3.3. gzclas	9
4. GNU Free Documentation License	11

Copyright (c) 2004, 2005 Ángel Herranz.

Se permite la copia, distribución y/o modificación de este documento bajo los términos establecidos en la Licencia de Documentación Libre GNU ('GNU Free Documentation License') Versión 1.1 o cualquier otra versión posterior publicada por la Fundación del Software Libre ('Free Software Foundation'); sin que el documento contenga secciones invariantes, portada o contraportada. Una copia completa de la licencia puede encontrarse en la sección bajo el título "GNU Free Documentation License".

GIROZ
Heat Manager
gzround

Ángel Herranz

July 2005

Abstract

One thing that RC car racers always miss is a reliable automatic lap counting system. Comercial transponder based systems (AMB) and infrared based systemas (LapZ) are unafordable for the ordinary racers and clubs.

GIROZ is an infrared transponder based system quite similar to LapZ, with a maximum of 24 transponders. Models run under a detector bridge and nothing can interrupt the the light between transponder and receptor in the bridge. Transponder consumption is less than 10mA while 2.4V is enough to detect the model.

Communication with a lap counter software system is implemented throught the paralel port and a sampling software module design for the system.

This document contains the user manual of several programs that allow the user to manage several heats.

Copyright (c) 2004, 2005 Ángel Herranz.

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.1 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, neither Back-Cover Texts. A copy of the license is included in the section entitled "GNU Free Documentation License".

1. Requisitos mínimos

Ordenador personal: Intel/AMD x386. El sistema ha sido probado con procesadores Intel Pentium II, Pentium III, Pentium IV¹ y AMD Athlon con **puerto paralelo**. La memoria necesaria dependerá de las exigencias de la distribución del sistema operativo utilizado. No es necesario que el ordenador disponga de disco duro aunque es recomendable que el ordenador disponga de algún tipo de dispositivo para poder extraer los datos de las carreras (*floppy*, *pen drive*, etc.).

Sistema operativo: GNU/Linux. El sistema ha sido probado con distintas distribuciones de GNU/Linux: Debian (<http://www.debian.org>), Slax (<http://www.slax.org>), Ubuntu (<http://www.ubuntu.com>), Fedora (<http://fedora.redhat.com>), Redhat (<http://www.redhat.com>) y Suse (<http://www.suse.com>). Se recomienda en especial el uso de **Debian** para mantener el sistema instalado o **Slax** como distribución “en vivo” (*live*).

2. Instalación del sistema GiroZ

La instalación del sistema GIROZ puede hacerse de dos formas distintas: descargando los binarios desde <http://www.giroz.net> e instalándolos en un directorio desde el que poder ejecutarlos o descargando las fuentes desde <http://www.giroz.net> y realizando una compilación de todo el sistema. En ambos casos el usuario necesitará privilegios de superusuario (*root*).

Instalación de binarios

Descargar el comprimido (*zip*) con los binarios `gztest`, `gzround` y `gzclas` y ejecutar el instalador `install-giroz` como *root* en un terminal²:

```
herranz:/tmp# whoami
root
herranz:/tmp# ls -al gzround-bin-0.2.0.zip
-rw-r--r-- 1 root root 200926 2006-02-05 12:57 gzround-bin-0.2.0.zip
herranz:/tmp# unzip gzround-bin-0.2.0.zip
Archive:  gzround-bin-0.2.0.zip
  inflating: gztest
  inflating: gzevent
  inflating: gzround
  inflating: gzclas
  inflating: README-giroz
  inflating: install-giroz
  inflating: gzround.pdf
  inflating: heat.cfg
herranz:/tmp# ./install-giroz
Installing GiroZ programs... done.
```

Compilación de las fuentes

En este caso el usuario deberá descargar la librería de GIROZ (`gzlib`) y `gzround`. En ambos casos la distribución se realiza mediante ficheros *tareados* y *gzip comprimidos*. La compilación e instalación del sistema deberá hacerse como superusuario siguiendo los siguientes pasos:

1. **Abrir un intérprete de comandos (shell).** Ésto se puede hacer de diversas formas: (a) entrando en una consola (basta pulsar Ctr-Alt-F1) directamente como *root*, (b) abriendo

¹El sistema no funciona correctamente con el microprocesador Celeron de Intel.

²Ver “Abrir un intérprete de comandos (shell)” en la sección “Compilación de las fuentes”

un terminal (en general disponible a través de los menús del sistema de ventanas como Root Terminal, (c) ejecutando un terminal desde la entrada del menú Ejecutar un programa y ejecutar entonces uno de los siguientes terminales: `gnome-terminal`, `kterm` o `xterm`. En el caso (c) hay que convertirse en root con la siguiente orden:

```
angel@herranz:~$ su -
Password:
herranz:~#
```

2. **Comprobar que somos root y que los ficheros comprimidos están en el directorio sobre desde el que vamos a iniciar la instalación (se sugiere que sea `/usr/local/src`):**

```
herranz:/usr/local/src# whoami
root
herranz:/usr/local/src# ls gzlib-0.1.2.tar.gz
gzlib-0.1.2.tar.gz
herranz:/usr/local/src# ls gzround-0.1.4.tar.gz
gzround-0.1.4.tar.gz
```

3. **Descomprimir ambos ficheros:**

```
herranz:/usr/local/src# tar xzf gzlib-0.1.2.tar.gz
herranz:/usr/local/src# tar xzf gzround-0.1.4.tar.gz
```

4. **Entrar en el directorio `gzlib-0.1.2`:**

```
herranz:/usr/local/src# cd gzlib-0.1.2
herranz:/usr/local/src/gzlib-0.1.2#
```

5. **Ejecutar las siguientes órdenes:**

```
herranz:/usr/local/src/gzlib-0.1.2# ./configure; make install
```

6. **Repetir los dos últimos puntos sobre el directorio `gzround-0.1.4`.**

Comprobación

Finalmente es necesario comprobar que el sistema está correctamente instalado, para ello el usuario debe entrar como un usuario normal y ejecutar el programa `gzround`. El resultado debería ser algo similar a:

```
angel@herranz:~$ gzround
GiroZ Round Manager 0.1.4
```

Copyright (C) 2004, 2005 Angel Herranz.

This is free software; see the source for copying conditions. There is NO warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

```
Usage: gzround <heat configuration file> (to start next leg)
       or: gzround                       (to see this help)
```

3. El programa `gzround`

El sistema GIROZ se basa en el tratamiento de las señales emitidas por los transponders y capturadas y procesadas en el puente de detección y está compuesto por los siguientes programas: `gztest`, `gzround` y `gzclas`

3.1. gztest

Con el programa `gztest` el usuario puede comprobar el número de transponder colocado en un modelo y su correcto funcionamiento antes de cada carrera.

3.2. gzround

El programa `gzround` permite gestionar **series**. Para ejecutarlo se utiliza la siguiente sintaxis en la línea de comandos:

```
[angel@babel angel]$ gzround serie1.cfg serie1-manga2.txt
```

En el ejemplo se supone la existencia del fichero `serie1.cfg` con la configuración de la serie (duración de las mangas, pilotos, transponders, tiempo mínimo por vuelta, etc.). Dicho fichero debe ser editado con cualquier **editor de texto/plano** (`vi`, `emacs`, `xedit`, `gedit`, `kedit`, etc.). En el mismo ejemplo, la ejecución de `gzround` almacenará la información de carrera en el fichero `serie1-manga2.txt`. El programa además genera eventos y clasificación así como numerosa información sobre detecciones, temporización, etc.

A continuación se muestra un **ejemplo de fichero de configuración de una serie**³:

```
description: This is a race configuration example

comment: line starting with the label "description:" contains a string
comment: with the description of the race. Less than 80 characters.

comment: lines starting with the label "comment:" are comments about the
comment: race (event, date, track, etc.). Less than 80 characters.

comment: lines starting with the label "lemans:" indicates the type of
comment: start with an integer number (0 = stopped, 1 = lemans)

comment: lines starting with the labels "duration:" and "min_lap_time:"
comment: contain, respectevly, an integer number representing the race
comment: duration (in minutes) and an integer number representing
comment: minimum time per lap (in seconds).

comment: line starting with the label "cars:" contains an integer number
comment: representing the number of cars participating in the race and
comment: must appear before any other line starting with the label
comment: "car:"

comment: lines starting with the label "car:" contains the car
comment: information: car number, transponder identifier and driver name.
comment: At least n car information pieces must appear being n the
comment: number indicated with the label "cars:".

lemans: 0

duration: 1

min_lap_time: 10

cars: 10
```

³Las líneas que comienzan con la etiqueta "comment:" pueden ser eliminadas

car: 1 12 ALO Fernando Alonso
 car: 2 9 FIS J. Carlo Fisichella
 car: 3 11 MSC Michael Schumacher
 car: 4 23 BAR Ruben Barrichello
 car: 5 4 RAI Kimmi Raikonen
 car: 6 18 MON J. Pablo Montoya
 car: 7 22 BUT Jason Button
 car: 8 1 WEB Mark Weber
 car: 9 25 TRU Jarno Trulli
 car: 0 16 VIL Jacques Villeneuve

La ejecución de gzround genera un fichero con los eventos de la carrera. Cada evento está indicando el número de coche, el piloto, la vuelta, tiempo total de carrera y tiempo de la última vuelta, si la detección se ha realizado automática o manualmente, si el programa sospecha que se pueda haber perdido la una vuelta de ese piloto (?), si ha mejorado su mejor vuelta (+) o si es vuelta rápida hasta ese momento (*), todas estas informaciones separadas por tabuladores. Un -1 sirve para indicar el final de los eventos y da paso a la clasificación final y la información de la vuelta rápida. Veamos como ejemplo el fichero generado por la ejecución anterior (serie1-manga2.txt):

7	BUT	Jason Button	1	00:00:10.54	00:10.54	*A	Pos 1
1	ALO	Fernando Alonso	1	00:00:11.06	00:11.06	+A	Pos 2
6	MON	J. Pablo Montoy	1	00:00:11.39	00:11.39	+A	Pos 3
4	BAR	Ruben Barrichel	1	00:00:11.60	00:11.60	+A	Pos 4
2	FIS	J. Carlo Fisich	1	00:00:11.70	00:11.70	+A	Pos 5
5	RAI	Kimmi Raikonen	1	00:00:11.97	00:11.97	+A	Pos 6
0	VIL	Jacques Villene	1	00:00:12.22	00:12.22	+A	Pos 7
9	TRU	Jarno Trulli	1	00:00:12.33	00:12.33	+A	Pos 8
8	WEB	Mark Weber	1	00:00:12.58	00:12.58	+A	Pos 9
3	MSC	Michael Schumac	1	00:00:19.73	00:19.73	+A	Pos 10
1	ALO	Fernando Alonso	2	00:00:21.41	00:10.35	*A	Pos 1
4	BAR	Ruben Barrichel	2	00:00:22.05	00:10.44	+A	Pos 2
2	FIS	J. Carlo Fisich	2	00:00:22.11	00:10.41	+A	Pos 3
8	WEB	Mark Weber	2	00:00:23.40	00:10.82	+A	Pos 4
0	VIL	Jacques Villene	2	00:00:24.17	00:11.94	+A	Pos 5
6	MON	J. Pablo Montoy	2	00:00:25.30	00:13.91	-A	Pos 6
7	BUT	Jason Button	2	00:00:30.78	00:20.23	-A?	Pos 7
9	TRU	Jarno Trulli	2	00:00:30.95	00:18.61	-A	Pos 8
2	FIS	J. Carlo Fisich	3	00:00:33.17	00:11.05	-A	Pos 1
1	ALO	Fernando Alonso	3	00:00:33.61	00:12.20	-A	Pos 2
4	BAR	Ruben Barrichel	3	00:00:34.79	00:12.74	-A	Pos 3
0	VIL	Jacques Villene	3	00:00:34.94	00:10.77	+A	Pos 4
6	MON	J. Pablo Montoy	3	00:00:35.32	00:10.01	*A	Pos 5
8	WEB	Mark Weber	3	00:00:35.63	00:12.23	-A	Pos 6
5	RAI	Kimmi Raikonen	2	00:00:36.13	00:24.15	-A?	Pos 9
3	MSC	Michael Schumac	2	00:00:39.56	00:19.83	-A	Pos 10
7	BUT	Jason Button	3	00:00:41.19	00:10.40	+A	Pos 7
9	TRU	Jarno Trulli	3	00:00:42.23	00:11.28	+A	Pos 8
1	ALO	Fernando Alonso	4	00:00:43.89	00:10.28	+A	Pos 1
2	FIS	J. Carlo Fisich	4	00:00:44.68	00:11.50	-A	Pos 2
6	MON	J. Pablo Montoy	4	00:00:45.66	00:10.34	-A	Pos 3
5	RAI	Kimmi Raikonen	3	00:00:46.79	00:10.66	+A	Pos 9
4	BAR	Ruben Barrichel	4	00:00:46.95	00:12.15	-A	Pos 4
0	VIL	Jacques Villene	4	00:00:47.02	00:12.07	-A	Pos 5
3	MSC	Michael Schumac	3	00:00:50.82	00:11.26	+A	Pos 10

```

8 WEB Mark Weber          4 00:00:54.80 00:19.16 -A Pos 6
7 BUT Jason Button       4 00:00:55.05 00:13.86 -A Pos 7
3 MSC Michael Schumac    4 00:01:01.05 00:10.22 +A Pos 1
9 TRU Jarno Trulli      4 00:01:03.11 00:20.88 -A? Pos 2
5 RAI Kimmi Raikonen     4 00:01:04.58 00:17.79 -A Pos 3
1 ALO Fernando Alonso   5 00:01:05.06 00:21.16 -A? Pos 1
8 WEB Mark Weber        5 00:01:05.61 00:10.81 +A Pos 2
6 MON J. Pablo Montoy   5 00:01:05.99 00:20.33 -A? Pos 3
4 BAR Ruben Barrichel   5 00:01:06.60 00:19.65 -A Pos 4
2 FIS J. Carlo Fisich   5 00:01:06.85 00:22.17 -A? Pos 5
0 VIL Jacques Villene   5 00:01:07.97 00:20.95 -A? Pos 6
7 BUT Jason Button      5 00:01:15.30 00:20.25 -A? Pos 7

```

-1

```

1 (1) ALO Fernando Alonso 5 00:01:05.06 4 (00:10.28)
2 (8) WEB Mark Weber     5 00:01:05.61 5 (00:10.81)
3 (6) MON J. Pablo Montoy 5 00:01:05.99 3 (00:10.01)
4 (4) BAR Ruben Barrichel 5 00:01:06.60 2 (00:10.44)
5 (2) FIS J. Carlo Fisich 5 00:01:06.85 2 (00:10.41)
6 (0) VIL Jacques Villene 5 00:01:07.97 3 (00:10.77)
7 (7) BUT Jason Button   5 00:01:15.30 3 (00:10.40)
8 (3) MSC Michael Schumac 4 00:01:01.05 4 (00:10.22)
9 (9) TRU Jarno Trulli   4 00:01:03.11 3 (00:11.28)
10 (5) RAI Kimmi Raikonen 4 00:01:04.58 3 (00:10.66)

```

BEST LAP TIME: 00:10.01 (MON J. Pablo Montoy)

Interfaz gráfico

El interfaz gráfico de `gzround` está implementado usando la librería `ncurses` y su información es autocontenida. Al iniciar el programa éste espera a que se pulse la tecla `I` para entrar en modo práctica con una cuenta atrás equivalente al tiempo de duración de la carrera. Terminada la cuenta atrás (o por deseo expreso del usuario pulsando la tecla `N`) el programa inicia la carrera advirtiendo con una cuenta atrás de cinco segundos con sonido incluido.

Información desde el teclado

Si por alguna razón el sistema de detección falla o alguno de (incluso todos) los coches no dispone de emisor, el usuario puede introducir datos manualmente. Pulsando la tecla con el número de coche (0, 1, 2, 3, 4, 5, 6, 7, 8, 9), el programa asume que el coche indicado acaba de cruzar la línea de meta y se incrementará en uno su número de vueltas actualizando los tiempos del piloto.

3.3. gzclas

El programa `gzclas` lee una serie de ficheros generados con el programa `gzround` y genera una distribución ordenada de los pilotos para las siguientes clasificatorias. Veamos el mensaje de ayuda:

```

[angel@exodo1 angel]$ gzclas
Processes GiroZ Round Manager leg results

```

Copyright (C) 2004, 2005 Angel Herranz.

This is free software; see the source for copying conditions. There is NO warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

```

Usage: gzclas <leg results>
      (to report best results)

```

```

or: gzclas [-a] <leg results>
      (to report all best results)
or: gzclas [-<h> -<n> [-<d>]] <leg results>
      (to distribute best drivers)
      <h> - number of heats to distribute drivers
            1 - final
            2 - semifinal
            4 - 1/4 final
            ...
      <n> - number of drivers to distribute in every heat
      <d> - number of drivers directly classified to the final (def: 0)
or: gzclas                               (to see this help)

```

Y veamos a continuación una serie de ejemplos de uso:

- La lista de todos los resultados en todas las series:

```

[angel@exodo1 angel]$ gzclas -a serie?-?.rac
=====
Drivers classified to the HEAT 1:
1  (3) Pablo Lorenzo           24  05:01.27    2 (00:11.32)
2  (3) Pablo Lorenzo           24  05:02.45    9 (00:10.96)
3  (8) Oscar Cremades          24  05:04.53   10 (00:11.46)
4  (3) Pablo Lorenzo           23  05:02.45   13 (00:11.51)
5  (8) Oscar Cremades          23  05:03.11   23 (00:11.58)
6  (8) Oscar Cremades          23  05:03.38   20 (00:11.92)
7  (2) Alberto Lopez           23  05:06.78   13 (00:11.98)
8  (4) Alvaro Cremades         23  05:07.47    3 (00:12.35)
9  (1) Angel Herranz           23  05:09.76    7 (00:11.64)
10 (2) Alberto Lopez           23  05:12.71    9 (00:11.93)
11 (6) Angel Herranz           23  05:12.85    1 (00:09.94)
12 (4) Alvaro Cremades         22  05:01.74   10 (00:12.59)
13 (1) Javier Montero          22  05:09.80   12 (00:13.00)
14 (9) Angel Herranz           22  05:13.02    5 (00:12.26)
15 (2) Alberto Lopez           22  05:14.62   10 (00:12.28)
16 (1) Javier Montero          21  05:05.02    8 (00:12.22)
17 (1) Javier Montero          21  05:06.57    3 (00:12.49)
18 (2) Antonio Cabezuelo       21  05:14.45    6 (00:13.32)
19 (2) Antonio Cabezuelo       20  05:03.02    2 (00:12.72)
20 (4) Alvaro Cremades         20  05:05.23    7 (00:12.89)
21 (2) Antonio Cabezuelo       19  05:08.54   13 (00:14.06)
22 (5) Miguel Laloma           15  05:04.34    6 (00:17.52)
23 (5) Miguel Laloma           14  05:17.56   10 (00:17.11)
24 (5) Miguel Laloma           12  05:20.86    1 (00:14.08)
25 (3) Angel Laloma            0  00:00.00    0 (99:59.99)
26 (3) Angel Laloma            0  00:00.00    5 (99:59.59)
27 (3) Angel Laloma            0  00:00.00    0 (99:59.99)

```

- La lista de los mejores resultados en todas las series:

```

[angel@exodo1 angel]$ gzclas serie?-?.rac
=====
Drivers classified to the HEAT 1:
1  (3) Pablo Lorenzo           24  05:01.27    2 (00:11.32)
2  (8) Oscar Cremades          24  05:04.53   10 (00:11.46)
3  (2) Alberto Lopez           23  05:06.78   13 (00:11.98)
4  (4) Alvaro Cremades         23  05:07.47    3 (00:12.35)
5  (1) Angel Herranz           23  05:09.76    7 (00:11.64)
6  (1) Javier Montero          22  05:09.80   12 (00:13.00)

```

7	(2)	Antonio Cabezuelo	21	05:14.45	6	(00:13.32)
8	(5)	Miguel Laloma	15	05:04.34	6	(00:17.52)
9	(3)	Angel Laloma	0	00:00.00	0	(99:59.99)

- La distribución a una clasificatoria de cuartos de final con dos pilotos en cada carrera:

```
[angel@exodo1 angel]$ gzclas -4 -2 serie?-?.rac
=====
Drivers classified to the HEAT 1:
1 (3) Pablo Lorenzo          24  05:01.27    2 (00:11.32)
2 (1) Angel Herranz         23  05:09.76    7 (00:11.64)
=====
Drivers classified to the HEAT 2:
1 (8) Oscar Cremades        24  05:04.53   10 (00:11.46)
2 (1) Javier Montero        22  05:09.80   12 (00:13.00)
=====
Drivers classified to the HEAT 3:
1 (2) Alberto Lopez         23  05:06.78   13 (00:11.98)
2 (2) Antonio Cabezuelo    21  05:14.45    6 (00:13.32)
=====
Drivers classified to the HEAT 4:
1 (4) Alvaro Cremades       23  05:07.47    3 (00:12.35)
2 (5) Miguel Laloma         15  05:04.34    6 (00:17.52)
=====
Not classified drivers:
9 (3) Angel Laloma          0  00:00.00    0 (99:59.99)
```

- La distribución a una clasificatoria de semifinales con tres pilotos en cada carrera y clasificando un piloto directo para la final:

```
[angel@exodo1 angel]$ gzclas -2 -3 -1 serie?-?.rac
=====
Drivers classified directly to the FINAL:
1 (3) Pablo Lorenzo          24  05:01.27    2 (00:11.32)
=====
Drivers classified to the HEAT 1:
1 (8) Oscar Cremades        24  05:04.53   10 (00:11.46)
2 (4) Alvaro Cremades       23  05:07.47    3 (00:12.35)
3 (1) Javier Montero        22  05:09.80   12 (00:13.00)
=====
Drivers classified to the HEAT 2:
1 (2) Alberto Lopez         23  05:06.78   13 (00:11.98)
2 (1) Angel Herranz         23  05:09.76    7 (00:11.64)
3 (2) Antonio Cabezuelo    21  05:14.45    6 (00:13.32)
=====
Not classified drivers:
8 (5) Miguel Laloma         15  05:04.34    6 (00:17.52)
9 (3) Angel Laloma          0  00:00.00    0 (99:59.99)
```

4. GNU Free Documentation License

GNU Free Documentation License
Version 1.1, March 2000

Copyright (C) 2000 Free Software Foundation, Inc.
59 Temple Place, Suite 330, Boston, MA 02111-1307 USA
Everyone is permitted to copy and distribute verbatim copies
of this license document, but changing it is not allowed.

0. PREAMBLE

The purpose of this License is to make a manual, textbook, or other written document "free" in the sense of freedom: to assure everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or noncommercially. Secondly, this License preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.

This License is a kind of "copyleft", which means that derivative works of the document must themselves be free in the same sense. It complements the GNU General Public License, which is a copyleft license designed for free software.

We have designed this License in order to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this License is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this License principally for works whose purpose is instruction or reference.

1. APPLICABILITY AND DEFINITIONS

This License applies to any manual or other work that contains a notice placed by the copyright holder saying it can be distributed under the terms of this License. The "Document", below, refers to any such manual or work. Any member of the public is a licensee, and is addressed as "you".

A "Modified Version" of the Document means any work containing the Document or a portion of it, either copied verbatim, or with modifications and/or translated into another language.

A "Secondary Section" is a named appendix or a front-matter section of the Document that deals exclusively with the relationship of the publishers or authors of the Document to the Document's overall subject (or to related matters) and contains nothing that could fall directly within that overall subject. (For example, if the Document is in part a textbook of mathematics, a Secondary Section may not explain any mathematics.) The relationship could be a matter of historical connection with the subject or with related matters, or of legal, commercial, philosophical, ethical or political position regarding them.

The "Invariant Sections" are certain Secondary Sections whose titles are designated, as being those of Invariant Sections, in the notice that says that the Document is released under this License.

The "Cover Texts" are certain short passages of text that are listed, as Front-Cover Texts or Back-Cover Texts, in the notice that says that the Document is released under this License.

A "Transparent" copy of the Document means a machine-readable copy,

represented in a format whose specification is available to the general public, whose contents can be viewed and edited directly and straightforwardly with generic text editors or (for images composed of pixels) generic paint programs or (for drawings) some widely available drawing editor, and that is suitable for input to text formatters or for automatic translation to a variety of formats suitable for input to text formatters. A copy made in an otherwise Transparent file format whose markup has been designed to thwart or discourage subsequent modification by readers is not Transparent. A copy that is not "Transparent" is called "Opaque".

Examples of suitable formats for Transparent copies include plain ASCII without markup, Texinfo input format, LaTeX input format, SGML or XML using a publicly available DTD, and standard-conforming simple HTML designed for human modification. Opaque formats include PostScript, PDF, proprietary formats that can be read and edited only by proprietary word processors, SGML or XML for which the DTD and/or processing tools are not generally available, and the machine-generated HTML produced by some word processors for output purposes only.

The "Title Page" means, for a printed book, the title page itself, plus such following pages as are needed to hold, legibly, the material this License requires to appear in the title page. For works in formats which do not have any title page as such, "Title Page" means the text near the most prominent appearance of the work's title, preceding the beginning of the body of the text.

2. VERBATIM COPYING

You may copy and distribute the Document in any medium, either commercially or noncommercially, provided that this License, the copyright notices, and the license notice saying this License applies to the Document are reproduced in all copies, and that you add no other conditions whatsoever to those of this License. You may not use technical measures to obstruct or control the reading or further copying of the copies you make or distribute. However, you may accept compensation in exchange for copies. If you distribute a large enough number of copies you must also follow the conditions in section 3.

You may also lend copies, under the same conditions stated above, and you may publicly display copies.

3. COPYING IN QUANTITY

If you publish printed copies of the Document numbering more than 100, and the Document's license notice requires Cover Texts, you must enclose the copies in covers that carry, clearly and legibly, all these Cover Texts: Front-Cover Texts on the front cover, and Back-Cover Texts on the back cover. Both covers must also clearly and legibly identify you as the publisher of these copies. The front cover must present the full title with all words of the title equally prominent and visible. You may add other material on the covers in addition. Copying with changes limited to the covers, as long as they preserve the title of the Document and satisfy these conditions, can be treated as verbatim copying in other respects.

If the required texts for either cover are too voluminous to fit legibly, you should put the first ones listed (as many as fit reasonably) on the actual cover, and continue the rest onto adjacent pages.

If you publish or distribute Opaque copies of the Document numbering more than 100, you must either include a machine-readable Transparent copy along with each Opaque copy, or state in or with each Opaque copy a publicly-accessible computer-network location containing a complete Transparent copy of the Document, free of added material, which the general network-using public has access to download anonymously at no charge using public-standard network protocols. If you use the latter option, you must take reasonably prudent steps, when you begin distribution of Opaque copies in quantity, to ensure that this Transparent copy will remain thus accessible at the stated location until at least one year after the last time you distribute an Opaque copy (directly or through your agents or retailers) of that edition to the public.

It is requested, but not required, that you contact the authors of the Document well before redistributing any large number of copies, to give them a chance to provide you with an updated version of the Document.

4. MODIFICATIONS

You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:

- A. Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any, be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.
- B. List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has less than five).
- C. State on the Title page the name of the publisher of the Modified Version, as the publisher.
- D. Preserve all the copyright notices of the Document.
- E. Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.
- F. Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.
- G. Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.
- H. Include an unaltered copy of this License.
- I. Preserve the section entitled "History", and its title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on the Title Page. If there is no section entitled "History" in the Document, create one

- stating the title, year, authors, and publisher of the Document as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.
- J. Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.
 - K. In any section entitled "Acknowledgements" or "Dedications", preserve the section's title, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.
 - L. Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.
 - M. Delete any section entitled "Endorsements". Such a section may not be included in the Modified Version.
 - N. Do not retitle any existing section as "Endorsements" or to conflict in title with any Invariant Section.

If the Modified Version includes new front-matter sections or appendices that qualify as Secondary Sections and contain no material copied from the Document, you may at your option designate some or all of these sections as invariant. To do this, add their titles to the list of Invariant Sections in the Modified Version's license notice. These titles must be distinct from any other section titles.

You may add a section entitled "Endorsements", provided it contains nothing but endorsements of your Modified Version by various parties--for example, statements of peer review or that the text has been approved by an organization as the authoritative definition of a standard.

You may add a passage of up to five words as a Front-Cover Text, and a passage of up to 25 words as a Back-Cover Text, to the end of the list of Cover Texts in the Modified Version. Only one passage of Front-Cover Text and one of Back-Cover Text may be added by (or through arrangements made by) any one entity. If the Document already includes a cover text for the same cover, previously added by you or by arrangement made by the same entity you are acting on behalf of, you may not add another; but you may replace the old one, on explicit permission from the previous publisher that added the old one.

The author(s) and publisher(s) of the Document do not by this License give permission to use their names for publicity for or to assert or imply endorsement of any Modified Version.

5. COMBINING DOCUMENTS

You may combine the Document with other documents released under this License, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice.

The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.

In the combination, you must combine any sections entitled "History" in the various original documents, forming one section entitled "History"; likewise combine any sections entitled "Acknowledgements", and any sections entitled "Dedications". You must delete all sections entitled "Endorsements."

6. COLLECTIONS OF DOCUMENTS

You may make a collection consisting of the Document and other documents released under this License, and replace the individual copies of this License in the various documents with a single copy that is included in the collection, provided that you follow the rules of this License for verbatim copying of each of the documents in all other respects.

You may extract a single document from such a collection, and distribute it individually under this License, provided you insert a copy of this License into the extracted document, and follow this License in all other respects regarding verbatim copying of that document.

7. AGGREGATION WITH INDEPENDENT WORKS

A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, does not as a whole count as a Modified Version of the Document, provided no compilation copyright is claimed for the compilation. Such a compilation is called an "aggregate", and this License does not apply to the other self-contained works thus compiled with the Document, on account of their being thus compiled, if they are not themselves derivative works of the Document.

If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one quarter of the entire aggregate, the Document's Cover Texts may be placed on covers that surround only the Document within the aggregate. Otherwise they must appear on covers around the whole aggregate.

8. TRANSLATION

Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this License provided that you also include the

original English version of this License. In case of a disagreement between the translation and the original English version of this License, the original English version will prevail.

9. TERMINATION

You may not copy, modify, sublicense, or distribute the Document except as expressly provided for under this License. Any other attempt to copy, modify, sublicense or distribute the Document is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

10. FUTURE REVISIONS OF THIS LICENSE

The Free Software Foundation may publish new, revised versions of the GNU Free Documentation License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. See <http://www.gnu.org/copyleft/>.

Each version of the License is given a distinguishing version number. If the Document specifies that a particular numbered version of this License "or any later version" applies to it, you have the option of following the terms and conditions either of that specified version or of any later version that has been published (not as a draft) by the Free Software Foundation. If the Document does not specify a version number of this License, you may choose any version ever published (not as a draft) by the Free Software Foundation.

ADDENDUM: How to use this License for your documents

To use this License in a document you have written, include a copy of the License in the document and put the following copyright and license notices just after the title page:

```
Copyright (c) YEAR YOUR NAME.
Permission is granted to copy, distribute and/or modify this document
under the terms of the GNU Free Documentation License, Version 1.1
or any later version published by the Free Software Foundation;
with the Invariant Sections being LIST THEIR TITLES, with the
Front-Cover Texts being LIST, and with the Back-Cover Texts being LIST.
A copy of the license is included in the section entitled "GNU
Free Documentation License".
```

If you have no Invariant Sections, write "with no Invariant Sections" instead of saying which ones are invariant. If you have no Front-Cover Texts, write "no Front-Cover Texts" instead of "Front-Cover Texts being LIST"; likewise for Back-Cover Texts.

If your document contains nontrivial examples of program code, we recommend releasing these examples in parallel under your choice of free software license, such as the GNU General Public License, to permit their use in free software.